PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F41A 5/08, 5/02 — A1

(11) International Publication Number: WO 97/14928

(43) International Publication Date: 24 April 1997 (24.04.97)

(21) International Application Number: PCT/GB96/02518

(22) International Filing Date: 15 October 1996 (15.10.96)

(30) Priority Data:
9521159.5 16 October 1995 (16.10.95) GB

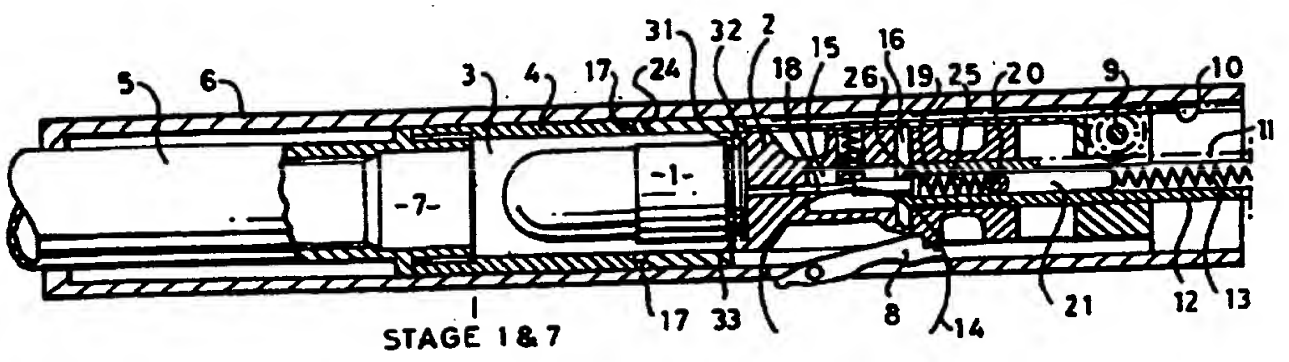
(71)(72) Applicant and Inventor: BRINT, Norman, Trevor [GB/GB]; 4 The Cobbins, Waltham Abbey, Essex EN9 1LH (GB).

(74) Agent: HEPWORTH LAWRENCE BRYER & BIZLEY; Merlin House, Falconry Court, Baker's Lane, Epping, Essex CM16 5DQ (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A WEAPON



(57) Abstract

A weapon comprises a body (6) defining a bore and a barrel assembly (5, 4, 2) slidable within the bore in a forward direction and in a rearward direction corresponding to recoil of the barrel assembly after firing. A recoil spring (13) is operable between the body and the barrel assembly to bias the barrel assembly into the forward direction. The barrel assembly comprises a barrel (5), a barrel extension (4) rearwardly from the barrel, and a breech block (2) slidably received in the barrel extension and co-operable with the barrel in a forward extremity of movement of the breech block relative to the barrel extension to define a chamber (7) within which a round (1) is fired in use. The breech block further comprises a firing mechanism (18, 19) to fire the round. A linkage (12, 9, 10, 11) connects the body, the barrel extension and the breech block, the linkage being operable to maintain the breech block in fixed relationship with the barrel during a part of a firing cycle in which the breech closes the chamber. The linkage is operable during the remainder of the firing cycle to provide differential movement between the breech block and the barrel such that the rate of movement of the breech block relative to the body is proportional to and greater than the rate of movement of the barrel extension relative to the body.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgystan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam

A Weapon

This invention relates t a weapon and in particular but not exclusively to a semi-automatic weapon firing rounds which have a radially projecting rim.

It is known to provide semi-automatic weapons in which a set of rounds stored in a magazine are sequentially fired, the semi-automatic action of the weapon being such that the user is required only to actuate a trigger to fire each round thereby enabling a number of rounds to be fired in quick succession, the remaining functions of the weapon being automatically operated using energy derived from recoil.

Such automatic weapons have typically been associated with relatively small calibre rounds.

The present invention is primarily but not exclusively concerned with hand held weapons of relatively large calibre and relatively low velocity.

According to the present invention there is disclosed a weapon comprising a body defining a bore and a barrel assembly slidable within the bore in a forward direction corresponding to the direction of firing of the weapon and in a rearward direction corresponding to recoil of the barrel assembly after firing, further comprising recoil spring means operable between the body and the barrel assembly to bias the barrel assembly into the forward direction; wherein the barrel assembly comprises a barrel, a barrel extension fixed to the barrel and projecting coaxially therefrom in the rearward direction, a breech block slidably received in the barrel extension and co-operable with the barrel in a forward extr mity of mov ment of the breech block relative to the barrel extension to define a chamber within which a round

is fired in use, and wh rein the breech block further comprises a firing mechanism operable in use to fire the round.

Preferably the weapon comprises a linkage operatively connecting the body, the barrel extension and the breech block, the linkage being operable to maintain the breech block in fixed relationship with the barrel during a part of a firing cycle of the weapon in which the breech closes a firing chamber defined by the barrel, and wherein the linkage is further operable to provide differential movement therebetween in which the rate of movement of the breech block relative to the body is proportional to and greater than the rate of movement of the barrel extension relative to the body.

Such an arrangement has the advantage of providing smooth operation and positive action.

According to a further aspect of the present invention there is disclosed a method of operating a weapon comprising the steps of;

(a) feeding in a feed direction a round from a magazine into a breech opening defined by a barrel extension connected to a barrel of the weapon, the feed direction being linear and transverse to a cylindrical axis of the barrel;

(b) engaging the round in contact with a breech block so as to retain the round against axial movement relative thereto by operation of retaining formations of the breech block engaging a radially projecting rim of the round;

(c) firing the weapon such that a spent casing of the round remains in engagement with the retaining formations.

(d) feeding a next round from the magazine into the breech opening and ejecting the spent casing from an ejection aperture, wherein the spent casing is ejected by action of an ejecting force applied to the spent casing by contact with the next round.

An advantage of such a method is that it is not necessary to provide a separate ejection mechanism for engaging the spent casing to eject it from the ejection aperture.

According to a further aspect of the present invention there is disclosed a method of operating a weapon comprising the steps of;

(a) feeding in a feed direction a round from a magazine into a breech opening defined by a barrel extension connected to a barrel of the weapon, the feed direction being linear and transverse to a cylindrical axis of the barrel;

(b) engaging the round in contact with a breech block so as to retain the round against axial movement relative thereto by operation of retaining formations of the breech block engaging a radially projecting rim of the round;

(c) actuating a trigger mechanism to release a barrel assembly for forward motion relative to a body of the weapon and within a bore defined by the body, the barrel assembly being constituted by the breech block, a barrel and a barrel extension within which the breech block is axially slidable;

(d) accelerating the barr l assembly forwardly by action of a spring and advancing the breech block at a speed which is proportional to and greater than the speed of the barrel extension until the breech block engages a rear end of the barrel thereby chambering the round; and

(e) firing the round while the barrel assembly continues to travel forwardly.

An advantage of such a method is to reduce the effects of recoil by firing the round while the barrel is moving forwardly and also providing positive and smooth feeding of the round by action of the breech block.

A preferred embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings of which

Figure 1 is a schematic part sectioned view showing the breech mechanism in accordance with the present invention, showing the position of breech components at a rest position of the firing cycle;

Figure 2 is a schematic view of the breech mechanism Figure 1 showing the position of components during a run out phase of the firing cycle;

Figure 3 is a schematic sectional view of the breech mechanism of previous Figures showing the position of components at a phase of the firing cycle in which the round is chambered;

Figure 4 is a schematic sectional view of the breech mechanism of previous Figur s showing the position of components at the point of firing the round;

Figure 5 is a schematic sectional view in side elevation in which the position of the round at different stages of the firing cycle is superimposed;

Figure 6 is a schematic side elevation showing the operation of an inner feed slide relative to the breech block of the mechanism of preceding Figures;

Figure 7 is a schematic view of the components of Figure 6 illustrating rearward motion of the inner feed slide to release a round;

Figure 8 is a schematic side elevation showing the components of Figures 6 and 7 after return forward motion of the inner feed slide;

Figure 9 is a schematic side elevation showing the relationship between an outer feed slide and the breech block;

Figure 10 is a schematic side elevation of the components of Figure 9 showing movement of the outer feed slide during recoil of the breech block;

Figure 11 is a schematic side elevation of the components of Figures 9 and 10 showing movement of the outer feed slide to release a round during ejection of a spent cartridge;

Figure 12 is a diagram in axial view illustrating the true position of a round retaining catch;

Figure 13 is a schematic axial view illustrating the positions of the inner and outer feed slides;

Figure 14 is a schematic axial view showing the position of the inner and outer feed slides relative to the rim of a round after disengagement of the inner feed slide from the rim;

Figure 15 is a schematic axial view showing the position of the outer feed slide relative to a round during ejection of a spent cartridge;

Figure 16 is a schematic part sectioned side elevation showing the relationship between the breech block and trigger;

Figure 17 is a schematic side elevation of the components of Figure 16 after actuation of the trigger to release the breech block;

Figure 18 is a schematic side elevation of the components of Figures 16 and 17 showing the recoil of the breech and motion of the inner feed slide and trigger;

Figure 19 is a schematic side elevation of the components of Figures 16 to 18 illustrating the manner in which the trigger is prevented from actuation after exhaustion of rounds in the magazine;

Figure 20 is a plan view of the components of Figure 19; and

Figure 21 is an external side view of a weapon including the components of preceding Figures.

Figure 1 shows schematically the manner in which a round 1 is held by a breech block 2 in a breech opening 3 defined by a cylindrical barrel extension 4. Figure 1 illustrates stage 1 of a firing cycle in which the weapon

is ready for action which will commence when triggered by an operator.

Figure 1 is generally a partly sectioned plan view with the weapon being oriented in a position of normal use in which rounds are fed in an upward vertical direction into the breech remain opening 3, the uppermost round 1 being shown in the drawing. The round 1 is a 40 mm calibre grenade round.

The barrel extension 4 is fixed to a barrel 5 such that both the barrel and the barrel extension are axially slidable within a cylindrical body 6 which is held in a fixed position by the user. As described below, the firing cycle includes an initial run out motion during which the barrel moves forward in the firing direction to a position in which relative movement of the breech block 2 moves the round 1 into a chamber 7 defined by a rear end of the barrel 5, the round then being fired while the barrel 5 is moving forward.

Relative movement of the barrel 5 and the body 6 is initially checked as shown in Figure 1 by a sear 8 pivotally mounted on the body and engaging the breech block 2.

Relative motion between the breech block 2 and the barrel extension 4 during run out is achieved by means of a geared pinion 9 rotatably mounted on the barrel extension 4 so as to engage a linear and axially extending rack 10 mounted on the body 6, the pinion at the same time engaging a second linear rack 11 extending axially along an actuating member in the form of an actuating rod 12 to which the breech block 2 is connected.

A compression coil spring 13 extends axially between a rear end of the body 6 and the actuating rod 12 so as to forwardly bias the actuating rod. When the sear 8 is moved in response to trigger actuation to a retracted position as shown in Figure 2, the actuating rod 12 together with the breech block 2 moves under action of the spring 13 in the forward direction, forward motion being simultaneously transmitted via the pinion 9 to the barrel extension 4, the gearing of the pinion and racks 10 and 11 in the preferred embodiment being arranged to transmit movement in the ratio 2:1, i.e. the barrel extension 4 and the barrel 5 move at half the speed of the breech block 2 during run out.

The views shown in Figures 1 and 2 include a sector 14 which is viewed in side elevation to reveal the operation of the sear 8, the remainder of the Figures 1 and 2 being viewed in plan.

As indicated above, the initial run out motion entails the actuating rod 12 being connected to the breech block 2 such that the actuating rod and breech block move in unison. The breech block 2 includes a cylindrical recess 15 into which a forward end 26 of the actuating rod 12 can advance during a later phase of the run out as illustrated in Figure 4 during which the actuating rod is freed from the breech block and the breech block 2 engages the barrel 5 to close the chamber 7 in readiness for firing. The position at which the breech block 2 engages the barrel 5 is shown in Figure 3.

In order to releasably connect the actuating rod 12 to the breech block 2, radially slidable coupling members in the form of locking plates 16 are mounted in the breech block to provide a releasable coupling and are arrang d such that, in the initial phase of run out, forward motion of the actuating rod into the recess 15 is

prevented by the locking plates 16 as shown in Figure 1. Recesses 17 to accommodate the locking plates 16 are provided in the barrel extension 4, the axial position of the recesses being such that the locking plates can move radially outwardly into the recesses in the configuration shown in Figure 3 at the same time as further relative motion between the breech extension 4 and breech block 2 is prevented by contact of the breech block with the barrel 5. The forward end 26 of the actuating rod 12 and the co-operating surfaces of the locking plates 16 are cammed so as to provide radial motion of the locking plates by cam action.

During this second phase of run out, the relative movement between the actuating rod 12 and the breech block 2 is utilised to release a firing pin 18 in order to fire the round 1. The firing pin 18 projects forwardly of the forward end of the actuating rod 12 and is forward biased by means of a firing pin compression spring 19 which is held in compression between the rear end of the firing pin and a stop in the form of a cross pin 20 fixed to the breech block. The rear end of the firing pin 18 projects into a cavity 25 within the actuating rod 12. A longitudinal slot 21 is formed in the actuating rod 12 with a forward end of the slot spaced from the forward end of the cavity. The cross pin 20 projects into the cavity 25 via the slot 21 thereby enabling the spring 19 to seat against the cross pin. During the second phase of run out, relative movement between the breech block 2 and the actuating rod 12 is accompanied by movement of the cross pin 20 along the slot 21, the reverse relative movement during recoil being responsible for axial compression of the firing pin compression spring 19 in readiness for a subsequent firing.

The firing pin 18 has a diameter which is stepped at a shoulder 22 which, as shown in Figure 3, is engaged by a catch 23 mounted on the breech block 2.

During the second phase of run out as illustrated in the transition from Figure 3 to Figure 4, the breech block 2 remains fixed relative to the barrel extension 4 and relative movement continues under actuation of the spring 13 with motion of the barrel 5, breech block 2 and the chambered round 1 continuing in unison at one half the speed of the actuating rod 12.

The catch 23 is provided with cam formations which enable the catch to be radially displaced by contact with the leading end of the actuating rod 12 to a retracted position as shown in Figure 4 in which the shoulder 22 is disengaged thereby allowing the firing pin 18 to move forward, actuated by the firing pin compression spring 19.

The round 1 is thereby fired leaving a spent cartridge case remaining in the chamber 7 and delivering a recoil impetus to the breech block 2 which immediately initiates recoil motion. During the initial phase of recoil, the recoil speed of the actuating rod 12 is twice that of the breech block 2, thereby withdrawing the firing pin 18 relative to the breech block to the position shown in Figure 3 where the catch 23 re-engages the shoulder 22. The firing pin 18 is thereby re-cocked ready for subsequent firing. Because of this relative motion, the separation between the cross pin 20 and the forward end of the cavity 25 decreases, thereby compressing the firing pin compression spring 19 to provide stored energy for subsequent actuation of the firing pin 18.

A second phase of recoil commences when the cross pin 20 encounters the forward end of the slot 21, th breech block 2 thereafter being constrained to move in unison with the actuating rod 12, and the locking plates 16 being moved radially inwardly by cam action between co-operating cam surfaces 24 of the locking plates and the barrel extension 4.

The recoil motion continues through the position shown in Figure 1 until recoil is arrested partly by compression of the spring 13 and partly by action of an energy absorbing unit (not shown). Run out then recommences under the impetus of the spring 13 which is compressed throughout the recoil motion.

The subsequent forward motion is halted when the breech block 2 encounters the sear 8 at a location in which the spent cartridge case is in alignment with an ejection aperture 27 as shown in Figure 5 and in alignment with the next round 28 in a magazine 29. As described below, the spent cartridge case is subsequently ejected by being displaced by movement of the next round 28 which is forced into the breech opening 3 by spring action.

Figure 5 shows in side elevation a number of positions of the round 1 and breech block 2 superimposed on the locus of the barrel extension 4, this drawing therefore being highly schematic. It must also be noted that the position of a round retaining catch 30 is schematically shown in Figure 5 for convenience at the upper radial extremity of the barrel extension 4 whereas in fact its true location is at a forty five degree position relative to vertical as shown in Figure 12.

As shown Figure 1 for example, the round 1 is held against axial movement relative to the breech block 2 by

means of retaining formations in the form of vertical guide ribs 31 which engage a rim 32 projecting radially from the rear end of the round, the ribs also extending into a cannelure 33 adjacent to the rim in a manner which allows vertical movement of the round (or spent cartridge case) during feeding of rounds or ejections of spent cartridge cases. The round retaining catch 30 is provided to selectively arrest any vertical movement of the round 1 so as to control movement through the ejection aperture 27. In the rest position corresponding to Figure 1, the round 1 is held as shown at position 1 in Figure 5 in which the round retaining catch 30 engages the rim 32 and prevents vertical movement. The catch 30 is pivotally mounted on the breech block 2 by means of a pivot pin 34 which extends through an axially extending slot 35 defined in the catch. A rear end of the catch 30 is also engaged by a compression spring 36 so as to forwardly bias the catch. The catch 30 has a radially projecting cam 37 co-operable with a first cam face 38 formed on the barrel extension at the forward end of the ejection aperture 27 and a second cam face 39 formed at the forward end of a port 40 formed in the barrel extension adjacent to its rear end.

The round retaining catch 30 is pivotally mounted in a manner which allows it to move between a raised position in which the cam 37 projects into either the ejection aperture 27 or the port 40 and a retracted position in which the cam is within the cylindrical side wall of the barrel extension. During the firing cycle, the breech block 2 and the round 1 are advanced from position 1 through position 2 as shown in Figure 5, the cam 37 engaging the first cam face 38 at position 2 thereby retracting the catch 30 to a position in which it no longer engages the rim radially but lies behind the rim of the round in a retracted position. The catch 30 remains in this retracted position throughout recoil and

return to the rest position. The catch 30 is thereby moved to its retracted position after each firing to allow ejection of the spent cartridge case. After ejection of the spent cartridge case, the spring 36 moves the catch 30 forwards into a position in which it arrests upward movement of the incoming next round 28 thereby returning to the position shown in Figure 5 at position 1.

During the firing cycle, the catch 30 recoils through a sufficient distance to encounter the port 40 but by then has already been retracted so as to be disengaged from the round 1.

When it is required to clear the weapon by emptying the magazine 29 without firing the weapon, the breech block 2 is manually retracted by means of a laterally projecting arm (not shown) projecting through a slot 79 in the body 6 (see Figure 21) thereby carrying the round 1 rearwardly with the breech block 2. During this rearward motion the catch 30 continues to engage the rim of the round 1 as shown at position 5 in Figure 5. The round 1 is thereby retracted until the base of the round contacts a spring loaded cam member 41 as shown in Figure 5 in a manner which displaces the round upwardly, the upward movement being accommodated by movement of the cam 37 into the port 40. The cam member 41 is formed as an upward projection on a first feed slide 44 described in greater detail below. The cam member 41 is initially moved rearwardly by contact with the round 1 but, following elevation of the round and cam action, the member moves forward by action of its associated spring 42 so as to return into its rest position shown at position 6 in Figure 5 in this position, the round is locked in this elevated position.

The breech block 2 is then allowed to move forwardly so that the round 1 moves forwardly, the round retaining catch 30 being initially retarded by abutment with the second cam face 39 so as to move rearwardly relative to the pin 34 and at the same time disengaging the rim of the round.

Subsequent further forward movement of the round 1 and breech block 2 results in the round retaining catch 30 being moved radially downwards by cam action to a retracted position as shown at position 8 of Figure 5 in which the catch abuts the rear face of the round and is clear of the rim.

This forward movement of the breech block 2 is subsequently arrested by the sear 8 and the round 1 is ejected through the ejection aperture 27 by being displaced by the next round 28 under spring action from the magazine 29.

This action of clearing rounds from the breech opening is repeated until the magazine 29 is empty.

A series of rounds will generally be stored in the magazine 29, the rounds being stacked in a row such that the rims of adjacent rounds contact one another at the same axial position. Since the rims have a slightly greater diameter than the casing of each round, a stack of such rounds will assume a slightly non-linear shape so that the magazine 29 will necessarily have an internal shape curved to conform with the shape of the stack of rounds. The magazine 29 incorporates a magazine spring 43 as indicated schematically in Figure 11 and which urges the rounds upwardly so that the feeding of rounds into the breech opening 3 is automatic. In order to retain a next round 28 in a position in which it is ready to be pushed into the breech opening 3 but will not

interfere with the reciprocating movement of the breech block 2 and barrel extension 4, the first feed slide 44 and a second feed slide 57 are located beneath the breech block 2 at a location rearward of a magazine opening 46 through which rounds are displaceable from the magazine 29. The first feed slide 44 extends longitudinally in a direction parallel to the breech block 2 as shown in Figure 6 and is axially moveable relative to fixed pins 47 and 48 to an extent defined by co-operating slots 49 and 50 formed in the first feed slide. The first feed slide 44 is also spring biased in the forward axial direction by means of a spring 51 as shown in Figure 6.

The first feed slide 44 has at its forward end a pair of lugs 52 which are laterally spaced apart as shown in axial projection in Figure 13 where the lugs are shown to engage the next round 28 at locations corresponding to plus or minus forty five degrees relative to the vertical.

As shown in Figure 6, the first feed slide 44 when at its rest position of maximum forward travel prevents upward motion of the next round 28 by action of the lugs 52 overlaying the upper surface of the rim 53 of the next round. A detent 54 projects upwardly from the rear end of the first feed slide 44 so as to be engagable by a co-operating formation 55 during recoil motion of the breech block 2 rearwardly of the rest position of Figure 1. The effect of such recoil motion is shown in Figure 7 to be rearward movement of the first feed slide 44 so as to disengage the lugs 52 from the rim 53 thereby allowing the next round 28 to rise under action of spring 43.

Subsequent release of the first feed slide 44 in consequence of forward motion of the breech block 2 allows the first feed slide to move forward under action of spring 51. The available travel is however limited by

contact between the lugs 52 and the rear end face 56 of th n xt round 28 as shown in Figure 8. In this position, the next round 28 is no longer restrained from vertical movement by the first feed slide 44.

The second feed slide 57 shown in Figure 9 is similarly located beneath the breech block 2 in proximity with the first feed slide 44. The second feed slide 57 extends generally axially and is mounted on pins 58 and 59 extending through respective slots 60 and 61 which are shaped so as to allow a forward end portion 62 of the second feed slide 57 to be upwardly displaceable against action of a spring 63 and to allow forward displacement of the second feed slide against action of a spring 64, the extent of movement in each case being limited by the shape of the slots 60 and 61. The second feed slide 57 is thereby spring loaded rearwardly and downwardly and is not influenced by rearward travel of the breech block 2. The forward end portion 62 similarly includes two forwardly projecting lugs 65 which, as shown in Figure 13, are disposed immediately adjacent to the lugs 52 of the first feed slide 44 so as to constitute outer and inner pairs of lugs respectively.

The lugs 65 of the second feed slide 57 differ from the lugs 52 of the first feed slide 44 in that the lugs 65 are shaped so as to engage and retain the rim 53 when the second feed slide 57 is in its rearward rest position but will release the rim to allow movement of the next round 28 when the second feed slide 57 is moved forward.

The second feed slide 57 includes an upwardly projecting detent 66 located at the forward end portion 62 so as to be engagable during forward motion of the breech block 2 if, and only if, the forward end portion 62 is fully raised against action of the spring 63. This will only occur when the rim 53 of the next round 28 is

engaged by the lugs 65 so that the spring pressure of the magazine spring 43 acts upwardly via the rounds in the magazine so as to upwardly move the forward end portion 62, the spring force of the spring 63 being selected to be substantially less than that of the magazine spring.

The formation 67 is arranged to engage the detent 66 in such a manner that the next round is released by movement of the lugs 65 only when the breech block 2 has fully recoiled and then returned forwardly to the rest position. The first and second feed slides 44 and 57 thereby co-operate to prevent release of the next round 28 until the breech block 2 reaches its rest position. The next round is initially retained by action of the first feed slide 44 while the breech block 2 is in the rest position, during run out and during the initial part of recoil. When the recoil motion reaches the point at which the breech block formation 55 engages the detent 54 (Figure 7), the first feed slide 44 releases the rim of the next round 28 which then rises into contact with the lugs 65 of the second feed slide 57.

The next round is thereby retained at a slightly higher level but still clear of the rim of the spent cartridge case 78 to avoid snagging during recoil (or clear of the rim of a live round which is manually retracted during reciprocating breech movement to empty the weapon).

Throughout the remaining recoil motion and subsequent forward travel towards the rest position the next round 28 is retained against upward motion by action of the second feed slide 57 which is raised by action of the magazine spring 43 into the position shown in Figure 10. On completion of the recoil and subsequent forward motion towards the rest position, the breech block formation 67 engages the detent 66 (Figure 11) thereby

effecting forward motion of the second feed slide 57, thereby releasing the rim 53 of the next round which is then free to rise into the breech opening 3 and in doing so displaces and ejects the spent cartridge case 78 as seen in Figure 15. The next round 28 thereby is allowed to rise to a position at which it is arrested by action of the round retaining catch 30.

A further subsequent round 68 as shown in Figure 11 will then follow the vertical path of the next round 28 until arrested by the lugs 52 of the first feed slide 44.

Operation of a trigger mechanism 69 is illustrated in Figures 16 to 20 where the trigger mechanism 69 comprises a trigger 70, the sear 8, and a trigger extension 71.

The trigger 70 is pivotally mounted to the body by means of a pivot pin 72 and the trigger extension 71 is in turn pivotally mounted on the trigger by means of a second pivot pin 73. The trigger extension 71 is thereby pivotal between an engaging position shown in Figure 16 in which it is operatively engaged by the sear 8 and a disengaged position as shown in Figure 18 in which it is disengaged from the sear such that any movement of the trigger when the trigger extension is in the disengaged position does not effect actuation of the sear.

The trigger extension 71 consists of a plate defining an aperture 74 (Figure 16)through which a catch member 75 of the sear 8 extends in the engaged position as shown in Figure 16. The trigger 70 is spring biased into a forward position as shown in Figure 16.

The trigger extension 71 is also spring loaded relative to the trigger in a direction tending to move it into engagement with the sear 8.

Figure 16 shows the trigger mechanism 69 in a ready for firing condition, corresponding to the configuration of Figure 1, such that manual actuation of the trigger so as to pivot about pivot pin 72 results in downward motion of the trigger extension 71, thereby downwardly displacing the catch member 75 and moving the sear 8 into its retracted position as shown in Figure 17 in which the breech block 2 is released so as to commence forward run out motion.

The trigger mechanism 69 includes a safety feature which will only allow actuation of the trigger 70 to release the sear 8 if a fresh round 1 has been fed into the breech opening 3. This safety feature is achieved by interaction between a safety slide and the trigger extension 71, the safety slide in this preferred embodiment being constituted by the first feed slide 44 as shown in Figure 18.

As described above with reference to Figures 6 to 8, rearward recoil movement of the breech block 2 displaces the first feed slide 44 rearwardly by engagement between the formation 55 of the breech block against detent 54 of the first feed slide 44. As shown in Figures 18 and 19, a lug 76 mounted on the first feed slide 44 is arranged to engage trigger extension 71 so as to move the trigger extension into its disengaged position in which it cannot engage the sear 8. The trigger extension 71 cannot therefore return into the engaged position with the sear 8 until such time as the first feed slide 44 returns to its forward position.

Because the trigger extension 71 is disengaged from the sear 8 by the formation 55 during recoil of the breech block 2, it is necessary for the sear to be re-engaged by the trigger formation before a further firing

can commence. This necessitates release of the trigger 70 to allow the trigger extension 71 to rise to a position where the catch member 75 can enter the aperture 74. A further safety feature is therefore inherent in the trigger mechanism 69 in that the trigger 70 must be separately actuated for each firing i.e. the trigger must be fully released before a next round can be fired.

Positive single shot action is thereby ensured by virtue of the interaction between the recoiling breech block 2 and the trigger mechanism 69.

The magazine incorporates a magazine platform 77 as shown in Figure 19 upon which the series of rounds within the magazine 29 are supported, the magazine platform 77 being spring biased by action of the magazine spring 43 so as to impart spring force to the rounds in the magazine.

The magazine platform 77 is shaped such that it can be fed into the breech opening 3 as shown in Figure 19 when all of the rounds in the magazine have been exhausted. The shape of the magazine platform 77 is however such as to prevent forward motion of the first feed slide 44.

When all of the rounds in the magazine 29 have been exhausted the magazine platform 77 is therefore allowed to enter the breech opening 3 and prevents any further actuation of the trigger 70 from releasing the sear 8.

The release of the breech 2 in the absence of a round being loaded into the breech opening 3 is thereby prevented.

Alternative embodiments are envisaged in accordance with the present invention in which for example the ratio

of movement between actuating member and barrel extension is other than 2:1. Increasing the ratio will have the effect of providing longer recoil to allow better absorption of recoil energy. Decreasing the ratio may be desirable where the overall weapon length is to be minimised.

The weapon may be adapted to fire rounds of larger or smaller calibre. The weapon is primarily intended for hand held use and to be shoulder fired. The weapon may alternatively be mounted on a suitable stand or vehicle if required.

In the preferred embodiment, the springs are helical coil springs. Other forms of spring such as gas springs may be used alternatively where appropriate.

In the preferred embodiment, the first feed slide 44 also acts as the safety slide. Alternatively the safety slide may be formed separately from the first feed slide.

Claims

1. A weapon comprising a body (6) defining a bore and a barrel assembly (5, 4,2) slidable within the bore in a forward direction corresponding to the direction of firing of the weapon and in a rearward direction corresponding to recoil of the barrel assembly after firing, further comprising recoil spring means (13) operable between the body and the barrel assembly to bias the barrel assembly into the forward direction; wherein the barrel assembly comprises a barrel (5), a barrel extension (4) fixed to the barrel and projecting coaxially therefrom in the rearward direction, a breech block (2) slidably received in the barrel extension and co-operable with the barrel in a forward extremity of movement of the breech block relative to the barrel extension to define a chamber (7) within which a round (1) is fired in use, and wherein the breech block further comprises a firing mechanism (18, 19) operable in use to fire the round.

2. A weapon as claimed in claim 1 comprising a linkage (12, 9, 10, 11) operatively connecting the body, the barrel extension and the breech block, the linkage being operable to maintain the breech block in fixed relationship with the barrel during a part of a firing cycle of the weapon in which the breech closes a firing chamber defined by the barrel, and wherein the linkage is further operable during the remainder of the firing cycle to provide differential movement therebetween in which the rate of movement of the breech block relative to the body is proportional to and greater than the rate of movement of the barrel extension relative to the body.

3. A weapon as claimed in claim 2 wherein the linkage comprises an actuating member (12) having a forward end portion connected to the breech block by means of a

releasable coupling (16, 17) and wherein the linkage provid s a rate of movement of the actuating memb r relative to the body which is proportional to and greater than the rate of movement of the barrel extension relative to the body by a predetermined ratio which remains fixed throughout a firing cycle of the weapon.

4. A weapon as claimed in claim 3 wherein the linkage comprises a geared pinion (9) rotably mounted to the barrel extension and co-operable with respective linear geared racks (10,11) mounted on the body and the actuating member.

5. A weapon as claimed in any of claims 3 and 4 wherein the predetermined ratio is two to one.

6. A weapon as claimed in any of claims 3 to 5 wherein the recoil spring means acts between the body and the actuating member.

7. A weapon as claimed in any of claims 3 to 6 wherein the releasable coupling disengages the breech block from the actuating member when the breech block engages the barrel to close the chamber, the releasable coupling comprising at least one coupling member (16) which is radially moveable relative to the axis of the bore between a coupling position and a retracted position in which the coupling member is accommodated in a recess (17) defined in the barrel extension to thereby uncouple the actuating member from the breech block.

8. A weapon as claimed in any of claims 3 to 8 wherein the firing mechanism comprises a firing pin (18) mounted for reciprocating motion relative to the actuating member, a firing pin spring (19) acting on the firing pin in a forward direction, and a firing pin catch (23) operable to retain the firing pin against forward

movement relative to the breech block until actuation of the firing pin catch by contact therewith by the forward end (26) of the actuating member.

9. A weapon as claimed in claim 8 wherein the firing pin spring is held in compression between the firing pin and a stop (20) fixed to the breech block whereby the spring is compressed during an initial phase of recoil by relative movement between the breech block and the actuating member.

10. A weapon as claimed in any preceding claim wherein the breech block comprises retaining formations (31) co-operable in use with a radially projecting rim (32) of a casing of a round so as to retain the casing captively relative to the breech block against relative axial movement therebetween throughout the firing cycle of the weapon.

11. A weapon as claimed in claim 10 wherein the body comprises a magazine (29) receiving in use a series of rounds in linear array such that the rounds are stacked side by side with the array extending in a feed direction transverse to the axis of the bore, the magazine communicating with the bore via a magazine opening (46), and wherein the feed mechanism is operable to feed a round from the magazine into a breech opening (3) via the magazine opening at a location such that the round is engaged by the retaining formations.

12. A weapon as claimed in claim 11 wherein the body defines an ejection aperture (27) aligned in the feed direction with the magazine opening whereby in use the feeding of a round into the breech opening displaces a casing of a spent round from the ejection aperture.

13. A weapon as claimed in any of claims 11 and 12 wherein the feed mechanism comprises first and second feed slides (44, 57) operable to arrest motion of a next round (28) in the feed direction, the first feed slide being operable to retain the next round in the magazine until the first feed slide is rearwardly displaced by the breech block during recoil, the second feed slide being operable to retain the next round after release from the first feed slide until disengaged from the next round by forward motion of the breech block, whereby the next round is thereafter free to travel in the feed direction into the breech opening.

14. A weapon as claimed in any of claims 11 to 13 comprising a round retaining catch (30) operable to arrest movement of a round in the feed direction at a location in which the round is held in the breech opening and engaged by the retaining formations.

15. A weapon as claimed in claim 14 wherein the round retaining catch is mounted on the breech block so as to be moveable between a forward position in which the round is retained and a retracted position in which the round is released, the catch comprising a spring (36) biasing the catch into the forward position, and wherein co-operating cam formations (38, 39) are provided on the catch and the barrel extension whereby the cam formations are co-operable to retract the catch to the disengaged position when the breech block is advanced forwardly from the location of the breech opening into the barrel extension.

16. A weapon as claimed in any preceding claim comprising a trigger mechanism (69) mounted on the body and operable to release the barrel assembly from a rest position when actuated.

17. A weapon as claimed in claim 16 wherein the fe d mechanism comprises a magazine platform (77) located in the magazine at the end of the array of rounds such that the magazine platform is fed into the breech opening when all of the rounds in the array are exhausted, the weapon further comprising a safety slide (44) engageable with the trigger mechanism to prevent actuation thereof when the magazine platform has been advanced into the breech opening.

18. A weapon as claimed in claim 17 as dependent from claim 13 wherein the safety slide is constituted by the first feed slide.

19. A weapon as claimed in claims 16 to 18 wherein the trigger mechanism comprises a trigger (70) pivotally mounted on the body, a trigger extension (71) pivotally mounted on the trigger and a sear (8) operable to retain the barrel assembly in a rest position in readiness for firing, the trigger extension being engageable with the sear to communicate actuation of the trigger to actuate the sear to release the barrel assembly, and wherein the safety slide is co-operable with the trigger extension to prevent engagement with the sear when the magazine platform has been advanced into the breech opening.

20. A weapon as claimed in claim 16 wherein the trigger mechanism comprises a trigger (70) pivotally mounted on the body, a trigger extension (71) pivotally mounted on the trigger and a sear (8) operable to retain the barrel assembly in a rest position in readiness for firing, the trigger extension being engageable with the sear to communicate actuation of the trigger to actuate the sear to release the barrel assembly, and wherein the breech block comprises a formation (55) co-operable with the trigger extension when the breech block is recoiled such

that re-engagement of the trigger extension with the sear requires the trigger to be released.

21. A method of operating a weapon comprising the steps of;

(a) feeding in a feed direction a round (1) from a magazine (29) into a breech opening (3) defined by a barrel extension (4) connected to a barrel (5) of the weapon, the feed direction being linear and transverse to a cylindrical axis of the barrel;

(b) engaging the round in contact with a breech block (2) so as to retain the round against axial movement relative thereto by operation of retaining formations (31) of the breech block engaging a radially projecting rim (32) of the round;

(c) firing the weapon such that a spent casing of the round remains in engagement with the retaining formations; and

(d) feeding a next round (28) from the magazine into the breech opening and ejecting the spent casing from an ejection aperture (27), wherein the spent casing is ejected by action of an ejecting force applied to the spent casing by contact with the next round.

22. A method as claimed in claim 21 wherein the ejection force is provided by a spring (43) of the magazine acting along the feed path.

23. A method of operating a weapon comprising the steps of;

(a) feeding in a feed direction a round (1) from a magazine (29) into a breech opening defined by a

barrel extension connected to a barrel (5) of the weapon, the feed direction being linear and transverse to a cylindrical axis of the barrel;

(b) engaging the round in contact with a breech block (2) so as to retain the round against axial movement relative thereto by operation of retaining formations (31) of the breech block engaging a radially projecting rim (32) of the round;

(c) actuating a trigger mechanism (69) to release a barrel assembly (5, 4, 2) for forward motion relative to a body (6) of the weapon and within a bore defined by the body, the barrel assembly being constituted by the breech block, a barrel (5) and a barrel extension (4) within which the breech block is axially slidable;

(d) accelerating the barrel assembly forwardly by action of a spring (13) and advancing the breech block at a speed which is proportional to and greater than the speed of the barrel extension until the breech block engages a rear end of the barrel thereby chambering the round; and

(e) firing the round while the barrel assembly continues to travel forwardly.

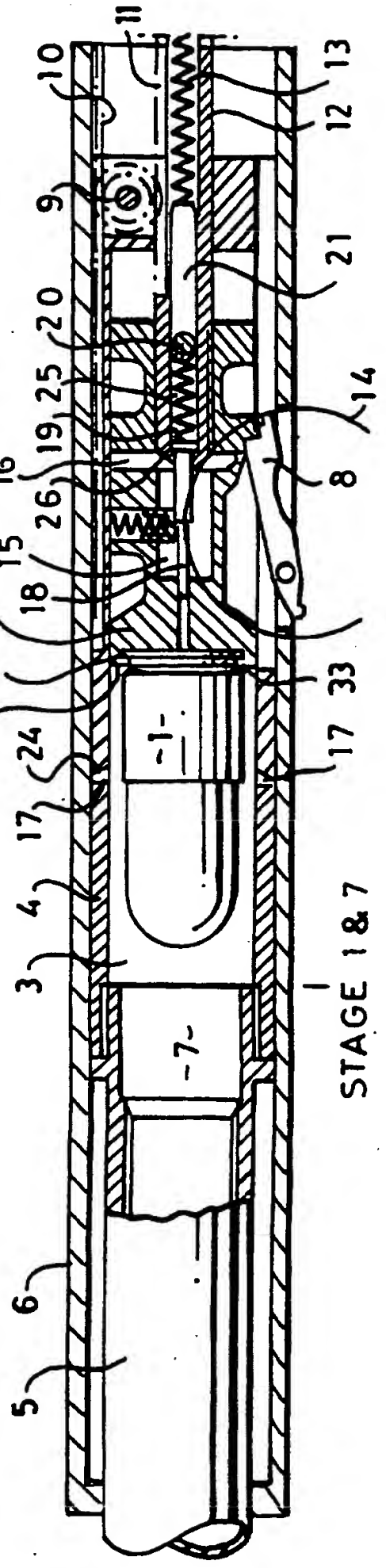

11
10
13
12
9
21
20
25
19
16
26
15
18
2
32
31
24
17
4
3
6
5
14
8
33
17
-1-
-7-
STAGE 1 & 7

FIG.1

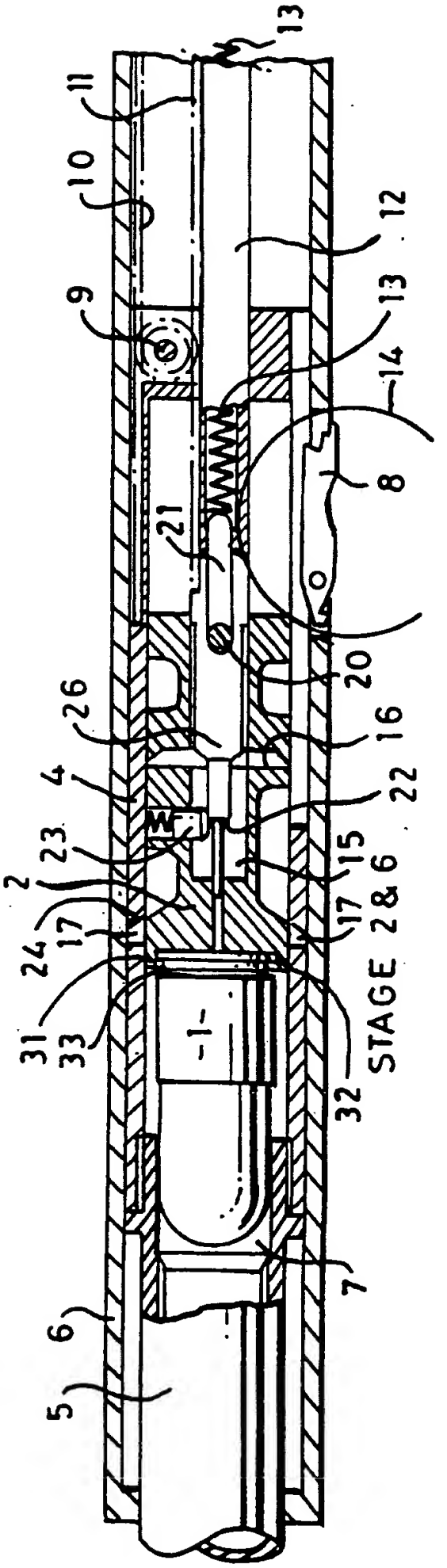

13
11
10
12
9
13
14
8
21
20
26
16
4
22
23
15
2
17
24
31
33
32
-1-
7
6
5
STAGE 2 & 6

FIG.2

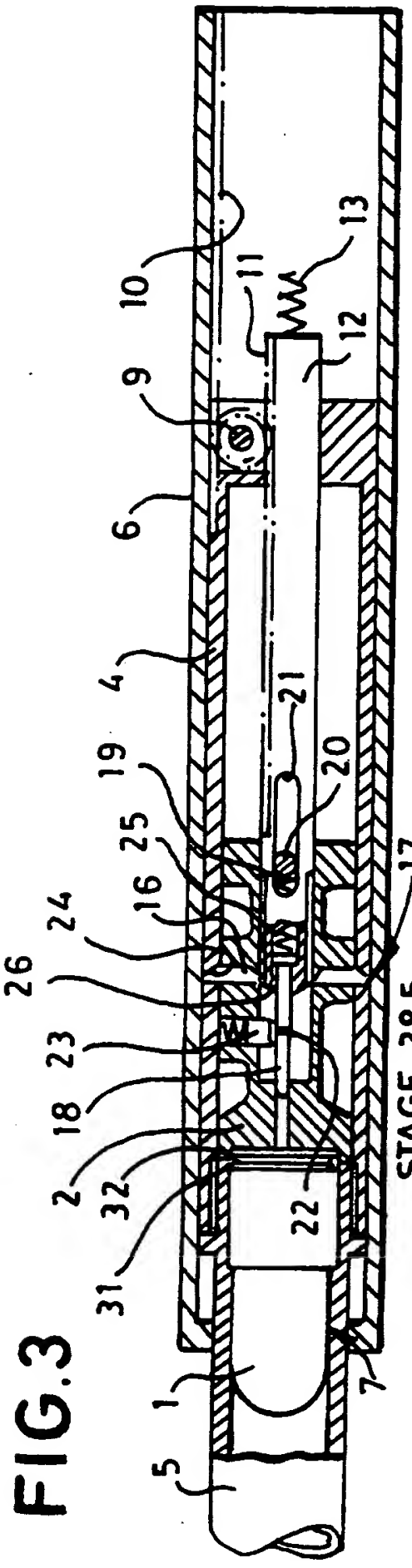

10
11
13
12
9
6
4
21
20
19
25
16
24
26
23
18
2
32
31
22
17
STAGE 3&5
1
5
7

FIG.3

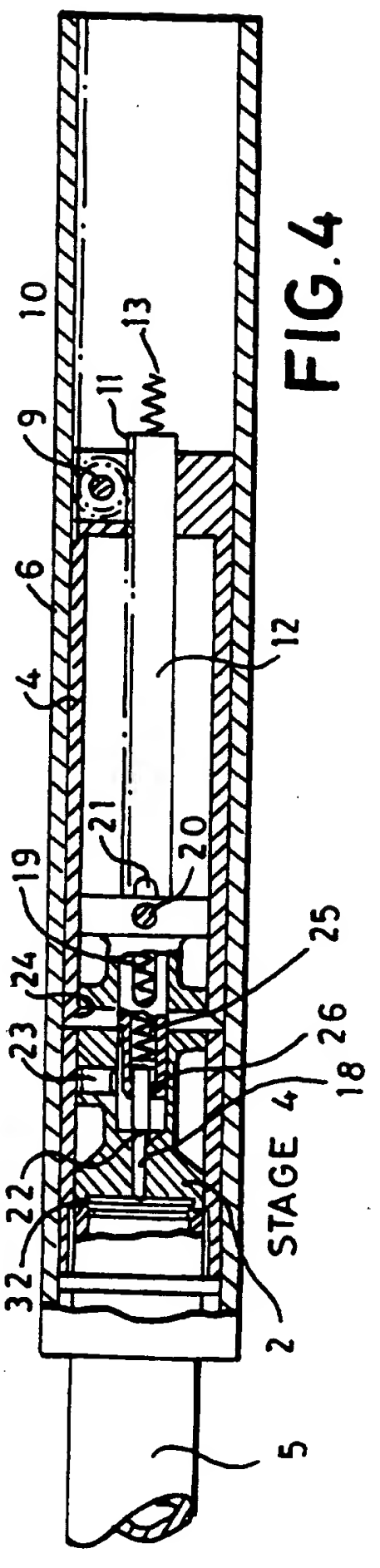

10
13
11
9
6
12
4
21
20
19
25
24
23
26
18
STAGE 4
22
32
2
5

FIG.4

FIG.5

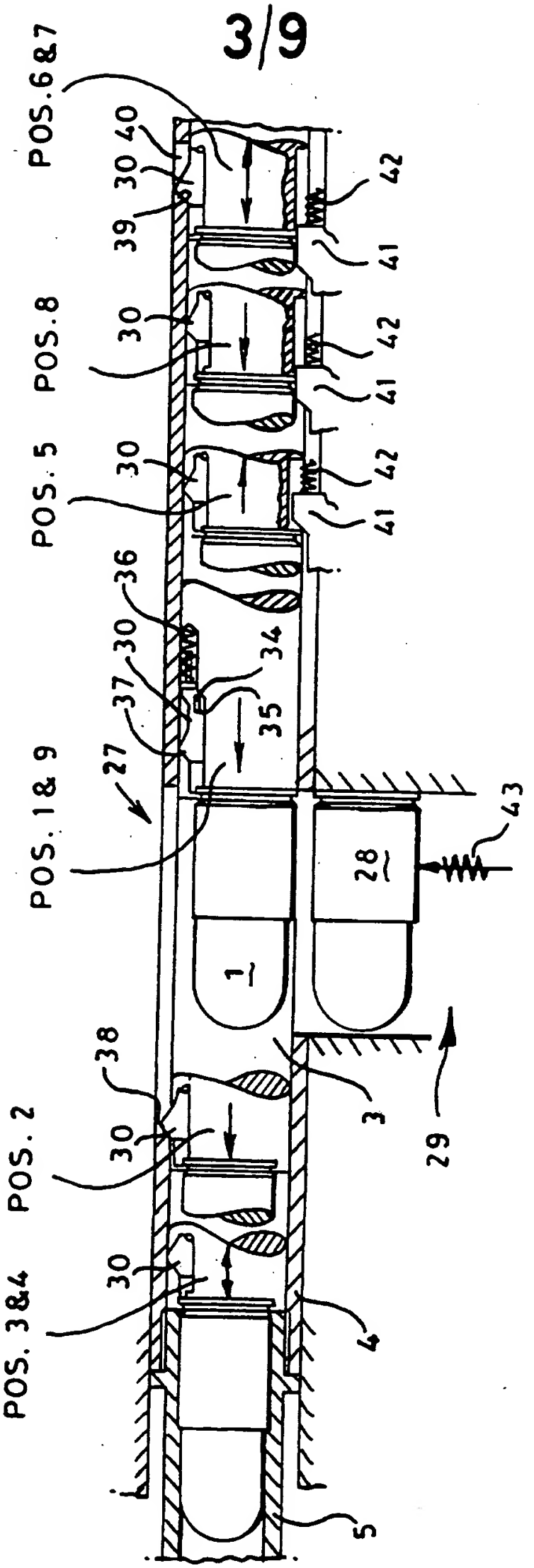

POS.6&7
40
30
39
42
41
POS.8
30
42
41
POS.5
30
42
41
36
30
37
34
35
POS.1&9
27
43
28
1
38
30
POS.2
3
29
30
POS.3&4
4
5

FIG.6

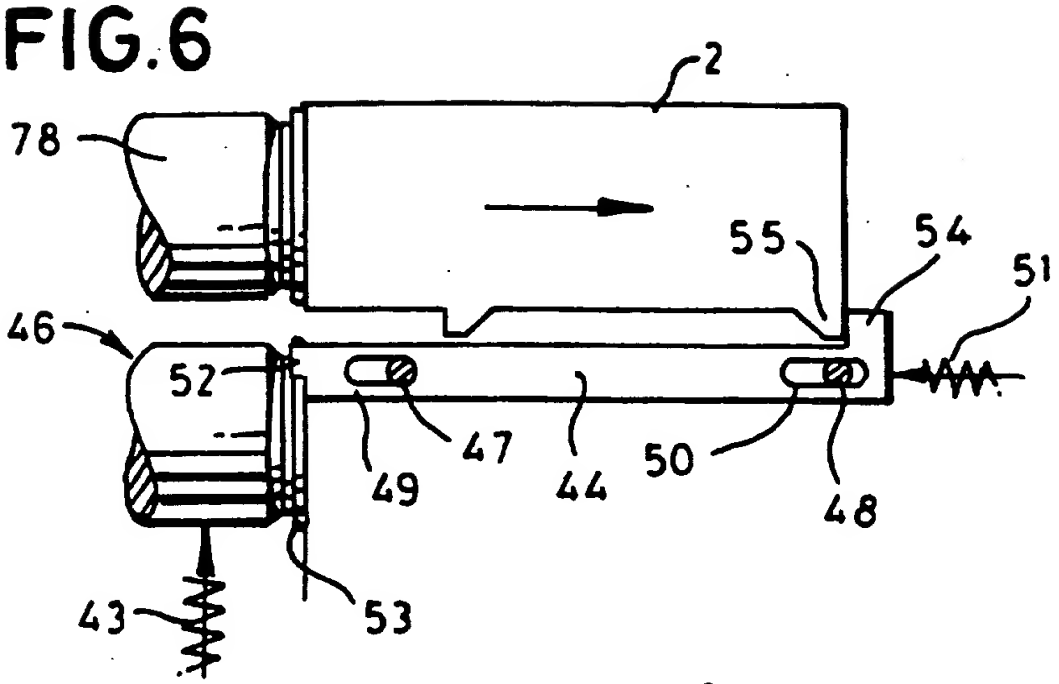


FIG.7

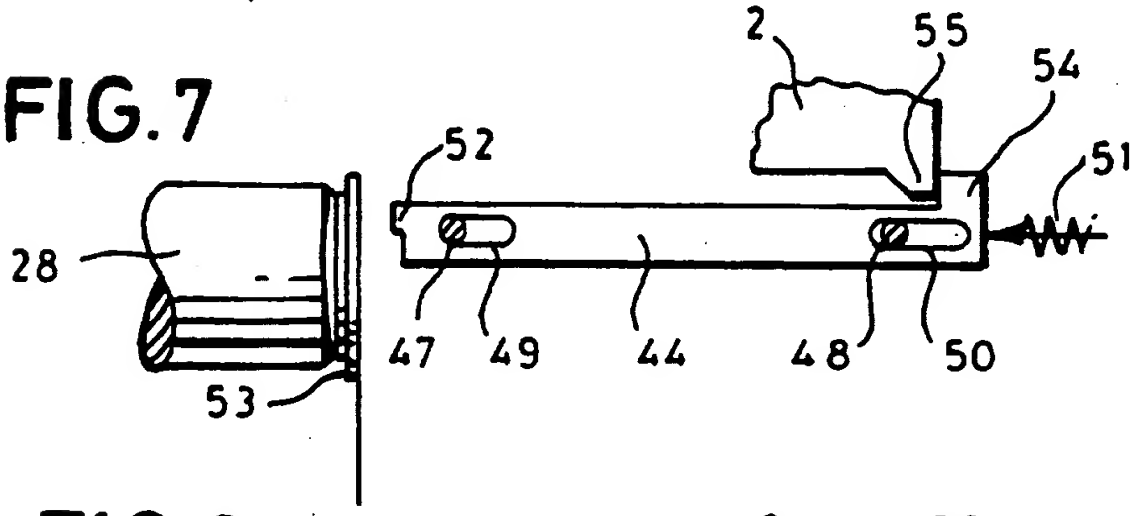


FIG.8

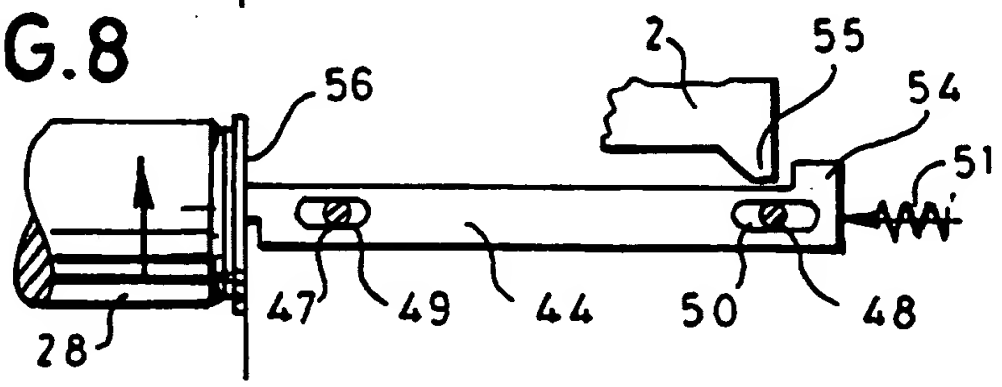


FIG.9

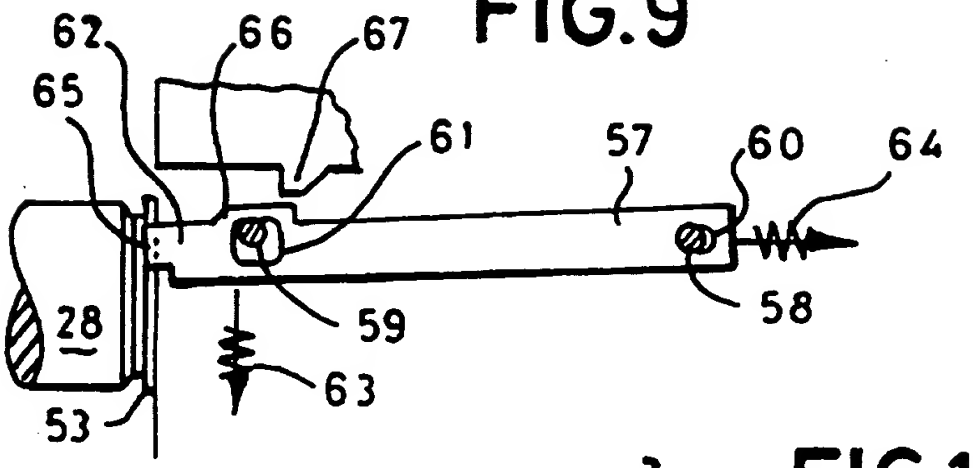


FIG.10

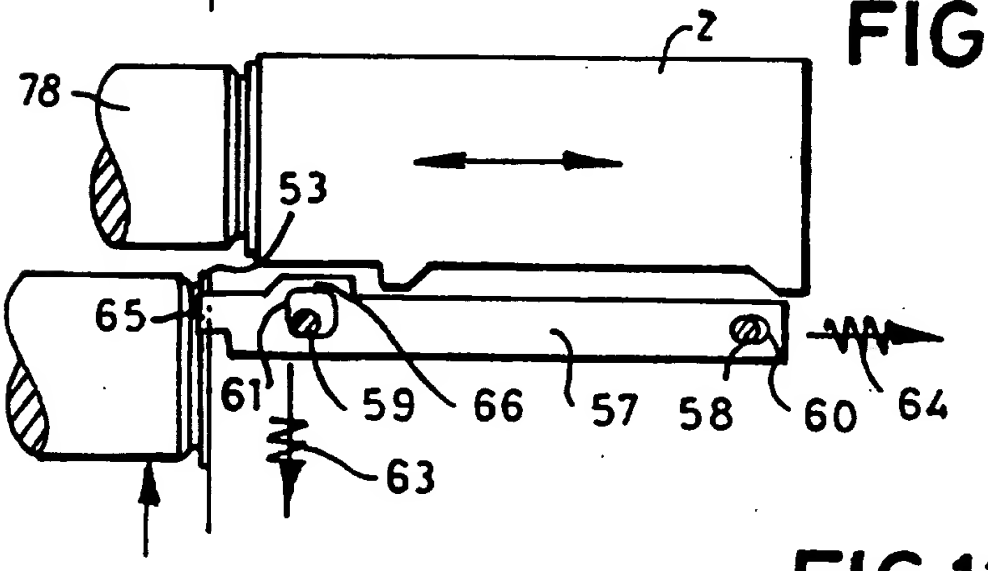


FIG.11

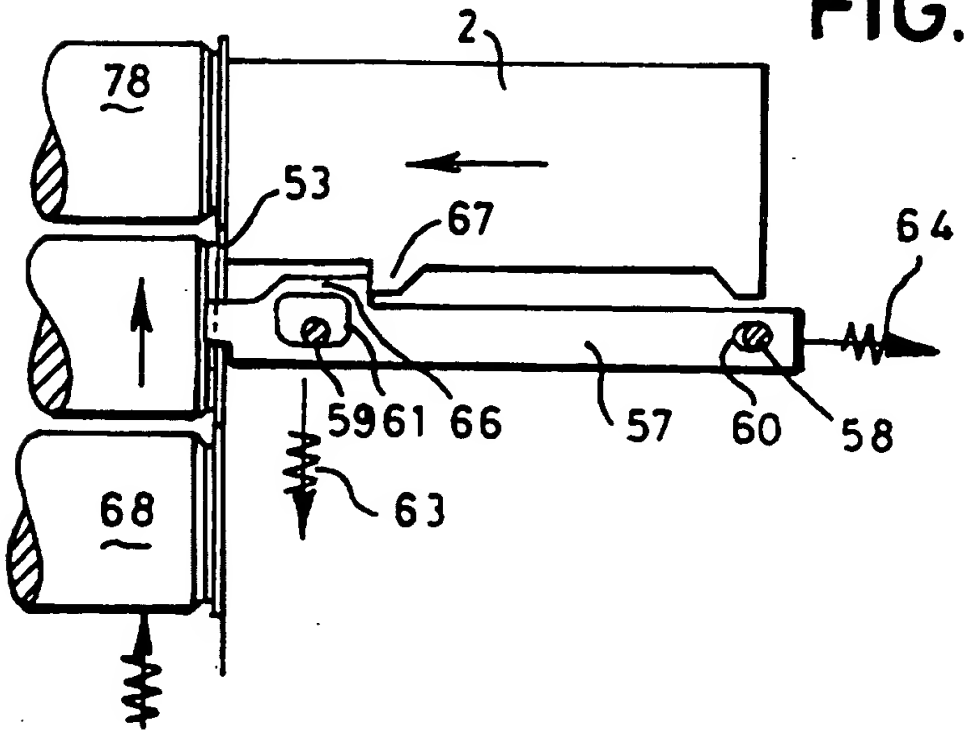


FIG.12

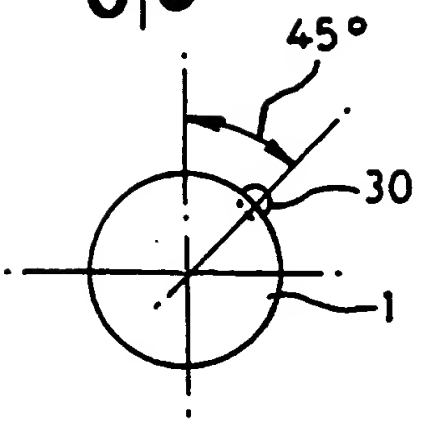


FIG.13

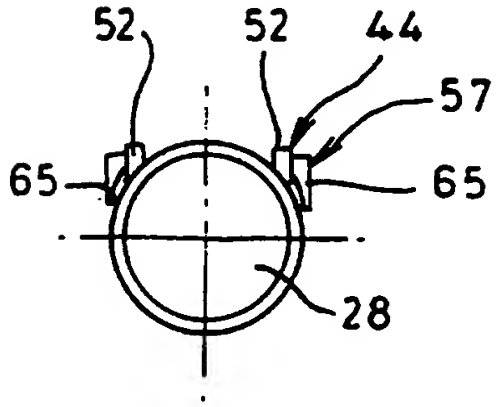


FIG.14

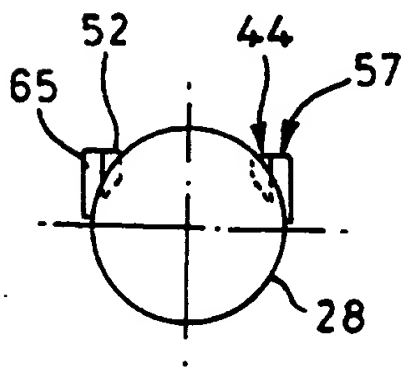


FIG.15

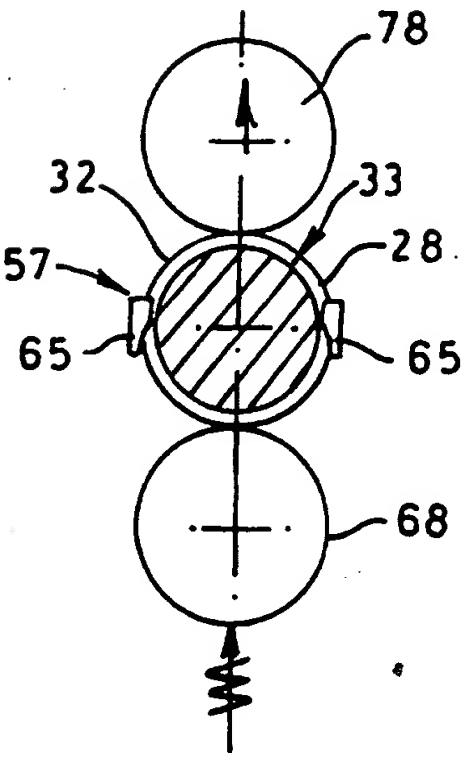


FIG.16

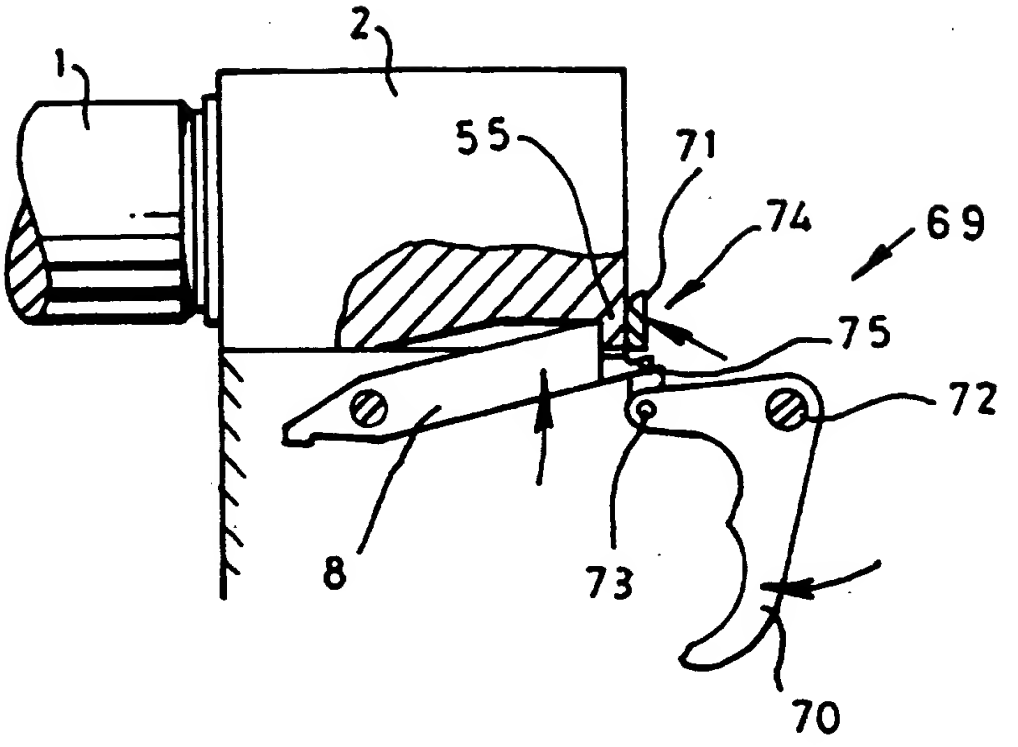


FIG.17

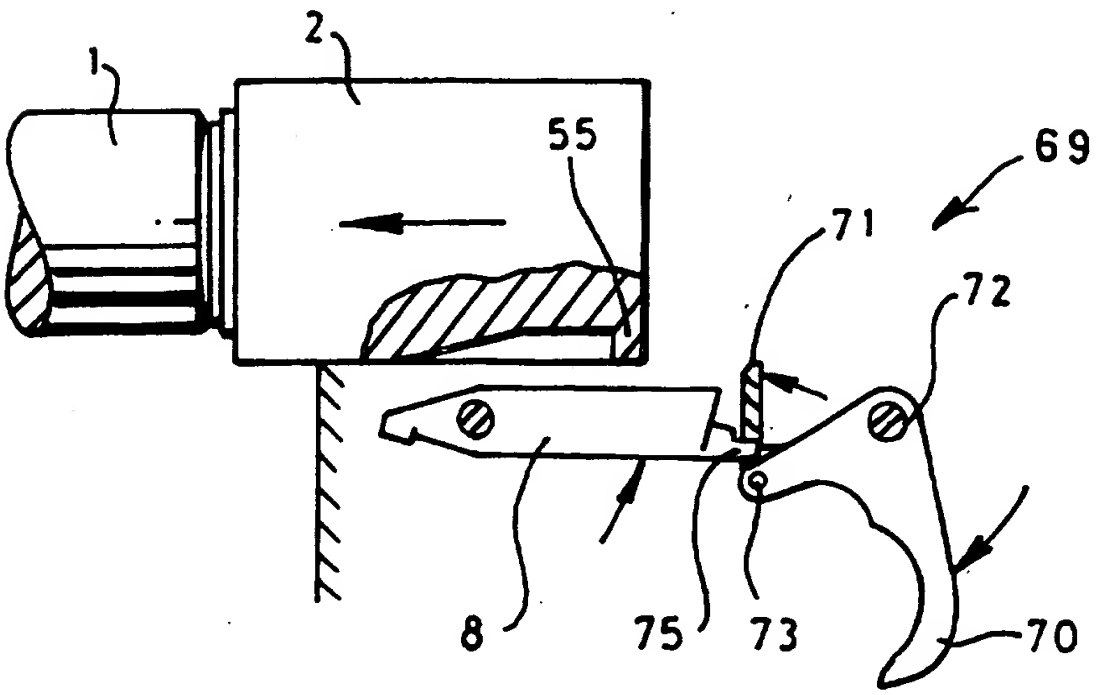


FIG.18

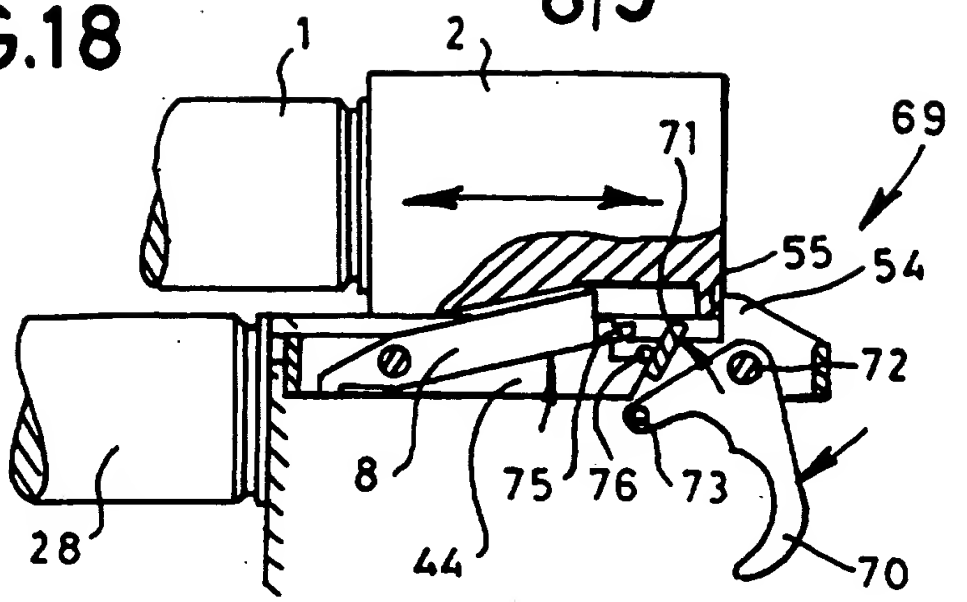


FIG.19

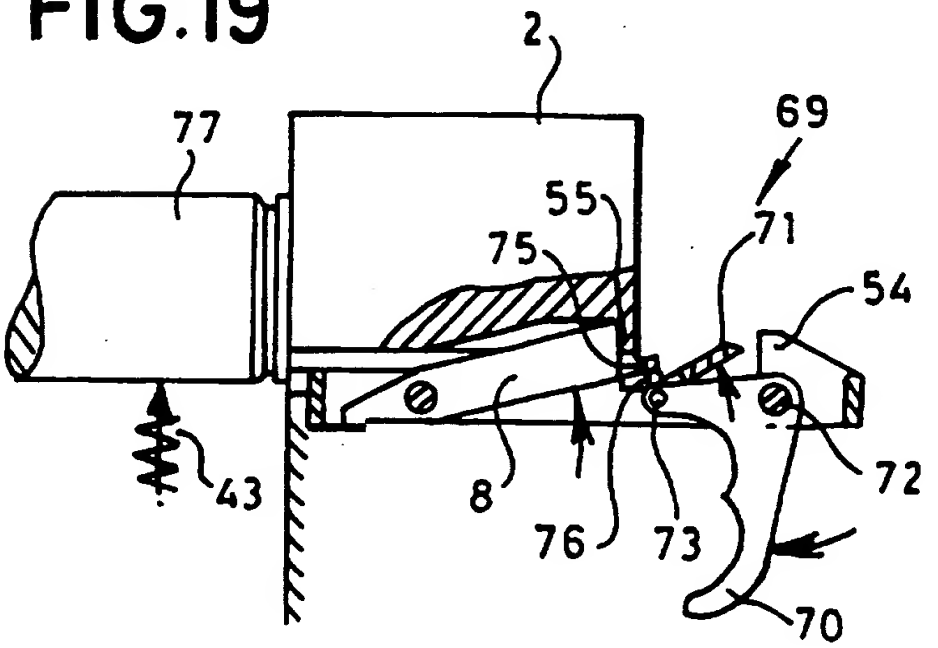
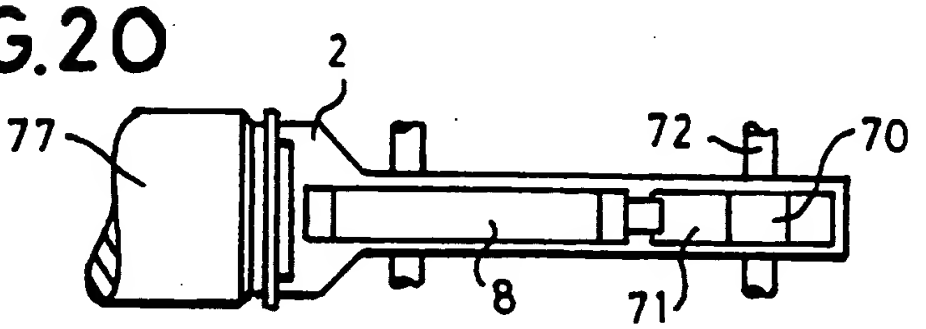


FIG.20



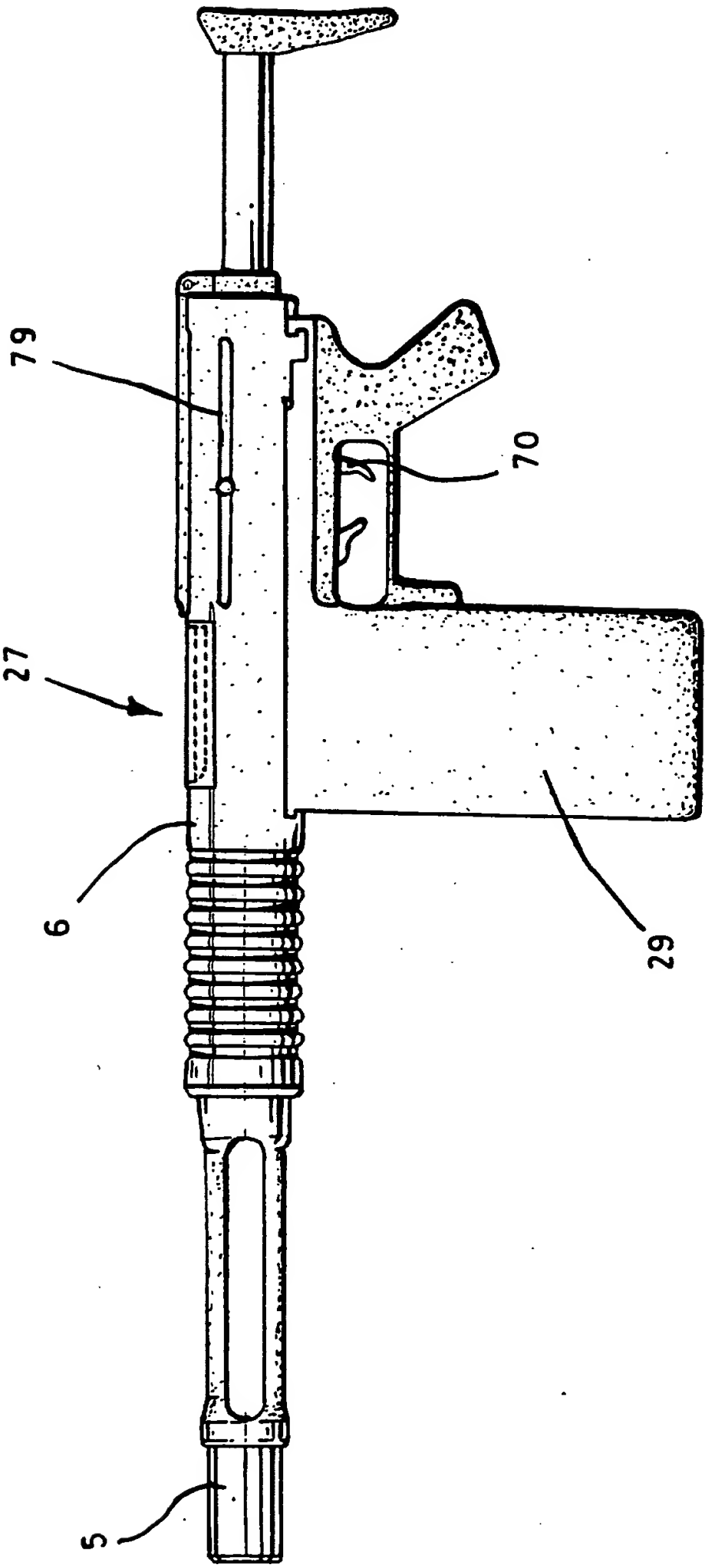


FIG. 21

INTERNATIONAL SEARCH REPORT

Intern ..al Application No
PCT/GB 96/02518

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F41A5/08 F41A5/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F41A

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 359 921 A (WOLFF) 1 November 1994 see abstract see column 3, line 27 - column 5, line 66 see column 7, line 66 - column 8, line 25 see column 9, line 14 - line 29; figures ---	1,21
A	US 3 687 001 A (BRINT) 29 August 1972 see column 3, line 7 - line 28; figures ---	2
A	US 5 155 292 A (ROSTCIL) 13 October 1992 -----	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 1997	06.03.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Rodolausse, P

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. Jnal Application No
PCT/GB 96/02518

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5359921 A	01-11-94	NONE	
US 3687001 A	29-08-72	CA 919965 A	30-01-73
		GB 1255921 A	01-12-71
US 5155292 A	13-10-92	DE 3585878 A	21-05-92
		EP 0198881 A	29-10-86
		JP 62500397 T	19-02-87
		WO 8602153 A	10-04-86